Original Article

A Survey of quality of oils used in Thai pig farms

Alongkot Boonsoongnern[1,2,3] Prapassorn Boonsoongnern[4] Pichai Jirawattanapong[1]

Nattavut Rattanavanichroj[1] Pariwat Poolperm[1*]

Abstract

Oil is commonly added into pig diets to increase energy in animal feed formulation. Fifty-eight oil samples: 1) crude coconut oil (n=11), 2) crude palm oil (n=6), 3) refined palm oil (n=6), 4) crude soybean oil (n=4), 5) refined soybean oil (n=5), 6) crude rice bran oil (n=6), 7) crude chicken oil (n=6), 8) crude lard (n=5) and 9) used oil (n=9) from pig farms, feed mills and traders in Thailand were collected and analyzed for quality by measurement of pH, percentage of total polar compounds (% TPC), peroxide value (PV), free fatty acid (FFA), iodine value (IV), percentage of impurity (% impurity) and percentage of moisture (% moisture). Results not only showed variations of oil quality in different kinds of oil, but also high variations of several parameters in some oils. As for palm oils, crude palm oil had higher FFA than refined palm oil (p=0.033), but significantly lower PV (p=0.005). The parameters of pH and FFA could be used for the identification of crude and refined grades of soybean oil. Correlation of % TPC between Thai commercial test kit and FOM 310 meter showed low positive correlation (approximately 25%). Therefore, the FOM 310 meter was recommended for checking % TPC of oils in pig farms and feed mills. Overall, the results of this study suggested that oil quality should be evaluated by the following parameters: % TPC, PV, FFA, IV, % impurity and % moisture.

Keywords: oil quality parameters, pig farm, survey, Thailand

[1]*Department of Farm Resources and Production Medicine, Faculty of Veterinary Medicine, Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom, Thailand*

[2]*Center for Agricultural Biotechnology, Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom, Thailand*

[3]*Center of Excellence on Agricultural Biotechnology: (AG-BIO/PERDO-CHE), Bangkok, Thailand*

[4]*Department of Anatomy, Faculty of Veterinary Medicine, Kasetsart University, Bangkok, Thailand*

***Correspondence**: fvetpap@ku.ac.th*

Introduction

Feed cost is the majority of cost in pig production in Thailand, which is approximately 70%. In general, energy source is beneficial to the improvement in pig performance. Adding some oils into the diet is usually practiced in swine feed formulation. In Thailand, soybean, rice bran and palm oils are commonly used in feed mills. However, the price of oil is a matter of concern to farmers due to its drastic increase of all kinds of oil. As a result, the utilization of used oil from human food industry has increasingly been introduced into "home made" feed formulation.

Used oil was well documented to increase oxidation of the oil, decrease feed intake and reduce average daily gain (ADG) in weaned pigs affected by oxidative stress (DeRouchey et al., 2004; Rosero et al., 2015). Many studies in rats and mice pointed out that oxidized oil induced oxidative stress and showed negative effect on immune response (Varady et al., 2011; Yen et al., 2010). There were some studies of distillers dried grains with solubles (DDGS) and oxidized fat which indicated that diets containing 30% oxidized DDGS negatively affected growth performance and reduced hot carcass weight, dressing percentage, back fat depth, and longissimus muscle area in nursery and finishing pigs (Boler et al., 2012; Song et al., 2014). Several recent studies have concluded that good oils can change their physical and chemical composition when they are exposed to high temperature, some organic materials and moisture. Examples of toxic compounds found in oil include 1,4-dioxane, benzene, toluene, hexyl-benzene and *p*-anisidine value (AnV) (Liu et al., 2014).

Thus, the quality of oil is the most important consideration for selecting oil in feed mills. Many parameters are analyzed for oil quality. 1) Free fatty acid (FFA) is a free form of fatty acid of which structures are changed by triglyceride by hydrolysis. A high number of FFAs is related to bad oil because it can easily make oil rancid and decrease pH. 2) Iodine value (IV) is the amount of iodine (grams) that inserts into the double bond (C=C) of fatty acid. Iodine numbers are used for measuring the amount of unsaturation in fatty acids. The unsaturation is in the form of double bonds which react with iodine compounds. The higher number of iodine, the more C=C bonds present in the fat. 3) Peroxide value (PV) is widely used to define the amount of peroxide oxygen per 1 kilogram of fat or oil. The concentration of peroxide in an oil or fat is useful for assessing the extent to which spoilage is advanced (Chakrabarty, 2003; Yin et al., 2011). Detection of peroxide for primary oxidation gives initial evidence of rancidity in unsaturated fats and oils. 4) Percentage of total polar compound (% TPC) is the several chemical compounds occurring from oxidation, hydrolysis, vaporization, dehydration and polymerization reactions. % TPC is the level of 25-27% as the rejection point for heated oils established by the regulatory agencies in European countries (Firestone et al., 1991; Paul and Mittal, 1997). However, % TPC has never been used to classify oil quality in animal feed industry.

Thai field observation found that oxidized oil might have an effect on production efficiency and pig health such as impairment of immune response and growth performance as well as increase in percentage of loss in nursery pigs. In fact, there has been a wide use of oxidized oils in Thai commercial farms and feed mills despite the little knowledge about the effect and the lack of attention from pig farmers. Therefore, the aim of this project was to survey the quality of oils used in Thai pig farms. The results would be useful for better selection of oils for pig feed formulation in pig farms and feed mills.

Materials and Methods

Oil samples: Fifty-eight oil samples were collected during February to March 2013, and divided into nine groups depending on kinds of oil: 1) crude coconut oil (n=11), 2) crude palm oil (n=6), 3) refined palm oil (n=6), 4) crude soybean oil (n=4), 5) refined soybean oil (n=5), 6) crude rice bran oil (n=6), 7) crude chicken oil (n=6), 8) crude lard (n=5) and 9) used oil (n=9). The samples were collected from 2 oil traders, 3 pig feed mills and 41 pig farms. All oil samples were obtained from the western (n=31), eastern (n=19), central (n=7), and north-eastern (n=2) parts of Thailand. The oil samples were collected into 500 ml sterile glass bottles and kept at 4°C until assay.

Laboratory analysis: The samples were evaluated for pH, % TPC, FFA, PV, % moisture, % impurity and IV as follows:

1) pH: all samples were simply measured for acid-base levels by pH meter 3 times per sample and then means of the pH were calculated.
2) % TPC: the samples were analyzed for % TPC using two different techniques. 2.1) By the commercial rapid test kit (the Department of Medical Sciences, Ministry of Public Health of Thailand), % TPC was graded as follows: 1 = 9-20%, 2 ≤ 24%, 3 ≤ 25%, 4 ≤ 26% and 5 ≤ 27%. 2.2) By FOM 310 meter (ebro® Electronic, Germany), the oil samples were boiled to 160°C and then % TPC was measured by FOM 310 probe.
3) PV: the samples were measured for PV using AOCS Official Method Cd 8b-90 (AOCS, 2009b).
4) FFA: all samples were checked for FFA according to AOCS Official Method Ca 5a-40 (AOCS, 2009a).
5) IV: the oils were analyzed for IV using the Lubrizol test procedure (Lubrizol et al., 2006).
6) % impurity: the samples were checked for % impurity following the method of animal and vegetable fat and oil determination of insoluble impurities (ISO, 2007).
7) % moisture: the oil samples were measured for percentage of moisture using the Mettler Toledo DL32 Karl Ficher Coulometric Titrator (Mettler-Toledo International Inc, the USA).

Statistical analysis: Results were primarily presented in terms of mean ± SD and in range using a descriptive statistical analysis. Correlation between the methods was used to detect % TPC by Spearman's rank correlation technique. In addition, all parameters

between the crude and refined grades of palm and soybean oils were analyzed by *t*-test using R program, R Core Team (2014) (R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria). A value of $p < 0.05$ was considered statistically significant.

Results

The results of all oil parameters are shown in Table 1. Crude rice bran oil, crude chicken oil, crude lard and used oil had lower pH than the others. Refined palm oil, crude chicken oil and crude lard showed very low level of % TPC, while crude coconut and crude rice bran oils had a huge number of % TPC. Crude rice bran oil had very high level of FFA followed by crude coconut oil and used oil. Surprisingly, not only crude rice bran and crude chicken oils had high levels of PV, but also both crude and refined soybean oils. Crude rice bran oil showed the highest level of % moisture that consequently found in used oil. Moreover, crude rice bran oil had higher % impurity than the other oils. Used oil showed the highest % impurity compared to the others. For IV, almost all oil samples were in their own normal range, except crude coconut oil and used oil (Table 1). For palm oils, crude palm oil had significantly higher FFA than refined palm oil (p=0.033), while crude palm oil showed lower PV than refined palm oil (p=0.005). The iodine value tended to increase in refined palm oil, but there was no significant difference (p=0.059). For soybean oils, there were no significant differences in all parameters between crude and refined soybean oils (Table 2).

The correlation of % TPC analysis between the two methods showed low positive correlation (Spearman's rho = 0.527). For the observation of oil prices, soybean oils were the most expensive followed by palm oils, crude lard, crude chicken oil, crude coconut oil and used oil.

Table 1 Analysis of oil samples

Oil sample (n)	Price (Baht)		pH		% TPC (FOM 310)		FFA	
	mean ± SD	range	mean ± SD	range	mean ± SD	range	mean ± SD	range
Crude coconut oil (11)	23.50 ± 2.09	22.00-27.00	6.30 ± 0.73	5.15-7.76	35.70 ± 9.95	10.50-40.00	8.83 ± 4.80	0.63-17.82
Crude palm oil (6)	25.20 ± 1.38	24.00-26.50	6.28 ± 0.64	5.34-6.98	18.90 ± 15.01	3.00-37.00	2.29 ± 1.76	0.18-4.85
Refined palm oil (6)	29.67 ± 1.21	29.00-32.00	6.72 ± 0.84	5.15-7.62	7.33 ± 10.33	2.00-28.00	0.29 ± 0.07	0.18-0.36
Crude soybean oil (4)	33.42 ± 8.95	28.00-43.80	6.95 ± 0.26	6.54-7.47	20.00 ± 8.62	10.00-27.00	1.71 ± 0.40	1.19-2.19
Refined soybean oil (5)	45.10 ± 2.01	43.00-47.50	6.11 ± 0.71	5.46-7.11	19.40 ± 9.93	9.00-32.00	1.24 ± 0.20	0.89-1.38
Crude rice bran oil (6)	22.00 ± 4.10	18.00-27.00	5.33 ± 0.48	4.69-5.77	31.83 ± 14.15	15.50-40.00	31.19 ± 20.27	9.74-60.48
Chicken oil (6)	24.67 ± 2.07	21.00-27.00	5.92 ± 1.04	4.48-7.03	9.50 ± 6.81	2.50-19.00	1.84 ± 1.04	0.79-3.54
Crude lard (5)	25.40 ± 3.05	22.00-29.00	5.40 ± 0.87	4.62-6.89	9.10 ± 6.92	2.00-23.50	1.18 ± 1.16	0.40-3.05
Used oil (9)	19.60 ± 4.40	13.00-27.00	5.81 ± 1.01	4.64-7.03	20.00 ± 8.58	9.50-40.00	7.50 ± 14.10	1.59-47.10

Table 1 Analysis of oil samples (Cont)

Oil sample (n)	PV*		% Moisture		% Impurity		IV[1]	
	mean ± SD	range	mean ± SD	range	mean ± SD	range	mean ± SD	range
Crude coconut oil (11)	7.79 ± 4.94	1.99-17.98	0.21 ± 0.08	0.12-0.40	0.02 ± 0.02	0.00-0.06	23.09 ± 22.74	12.00-88.00
Crude palm oil (6)	4.73 ± 1.62	1.98-5.96	0.08 ± 0.03	0.04-0.11	0.09 ± 0.16	0.02-0.42	34.83 ± 22.69	16.00-59.00
Refined palm oil (6)	8.59 ± 1.62	5.94-9.92	0.07 ± 0.02	0.04-0.09	0.02 ± 0.01	0.01-0.04	56.80 ± 0.98	56.00-58.00
Crude soybean oil (4)	10.45 ± 3.44	5.95-12.00	0.13 ± 0.04	0.06-0.25	0.06 ± 0.02	0.01-0.10	108.50 ± 26.58	75.00-128.00
Refined soybean oil (5)	18.23 ± 12.62	7.92-35.64	0.09 ± 0.03	0.06-0.14	0.00 ± 0.00	0.00-0.00	114.80 ± 22.99	74.00-127.00
Crude rice bran oil (6)	12.93 ± 10.30	1.98-31.87	12.19 ± 18.50	0.74-46.29	1.97 ± 2.60	0.06-5.56	82.67 ± 14.29	59.00-98.00
Chicken oil (6)	12.87 ± 13.36	3.98-39.20	0.12 ± 0.16	0.01-0.20	0.13 ± 0.19	0.00-0.50	73.50 ± 9.59	59.00-85.00
Crude lard (5)	5.17 ± 2.27	1.99-7.98	0.17 ± 0.25	0.02-0.62	3.15 ± 3.94	0.61-10.16	66.20 ± 6.69	55.00-71.00
Used oil (9)	6.75 ± 2.13	3.96-9.92	6.61 ± 20.08	0.04-63.76	2.56 ± 7.41	0.05-23.64	67.60 ± 21.58	10.00-93.00

* The unit of PV is mEq/kg.

[1] The normal range of IV is 6.3-10.6 for coconut oil, 50.0-55.0 for crude palm oil, 14.1-21.0 for palm kernel oil, 20.0-28.0 for palm kernel olein oil, 90.0-115.0 for rice bran oil, 124.0-139.0 for soy bean oil, 48.0-54.0 for lard (FAO, 2009) and 45-75 for lard (Ockerman, 1991).

Table 2 Differentiation between crude and refined grades of palm oil and soy bean oil analyzed by *t*-test technique (data reported as mean ± SD)

Parameter	Crude palm oil	Refined palm oil	*p*-value	Crude soy bean oil	Refined soy bean oil	*p*-value
pH	6.28 ± 0.64	6.72 ± 0.84	0.418	6.95 ± 0.26	6.11 ± 0.71	0.075
% TPC	18.90 ± 15.01	7.33 ± 10.33	0.227	20.00 ± 8.62	19.40 ± 9.93	0.926
FFA	2.29 ± 1.76	0.29 ± 0.07	0.033	1.71 ± 0.40	1.24 ± 0.20	0.076
PV	4.73 ± 1.62	8.59 ± 1.62	0.005	10.45 ± 3.44	18.23 ± 12.62	0.272
% Moisture	0.08 ± 0.03	0.07 ± 0.02	0.383	0.13 ± 0.04	0.09 ± 0.03	0.389
% Impurity	0.09 ± 0.16	0.02 ± 0.01	0.302	0.06 ± 0.02	0.00	ND
IV	34.83 ± 22.69	56.80 ± 0.98	0.059	108.5 ± 26.58	114.8 ± 22.99	0.704

Discussion

The results revealed a high number of standard deviations of means in all parameters due to huge variations in oil quality on pig farms. Crude coconut oil had a high IV because two of the eleven samples had more IV than expected. It is possible that the samples might have different types of oil added into the coconut oil. Normally, coconut oil is composed of saturated fatty acid, so it is quite impossible for

coconut oil to have such a high IV (APCC, 2003; Katragadda et al., 2010). Moreover, coconut oil had a higher number of % TPC than the other oils because it consists of a lot of medium and short chain saturated fatty acids that easily break from triglyceride molecules (Choe and Min, 2007; FAO, 2009). However, the crude oils tended to have a higher % TPC than the refined oils. For the result of FFA, used oil showed an extremely high number of FFA (47.1%) compared to the other samples having FFA in the normal range. Some studies reported that used oil from a waste clarifier could reobtain normal FFA range by adding chemical or absorbent agents before being sold (Bhattacharya et al., 2008; Lin et al., 2001). The increase in FFA is also associated with the action of several enzymes such as lipases, peroxidases and phospholipases in the grains or the microflora contributing to the breakdown of triglyceride ester bonds (Zadernowskl et al., 1999). The result of PV ranging from 1.98-39.20 mEq/kg implies that Thai oils have a high variation of oxidation states. PV is classified into 3 oxidation levels: low, 1-5 mEq/kg; medium, 5-10 mEq/kg; and high, 10-20 mEq/kg (O'Brien, 2004). Unsurprisingly, crude rice bran oil had the lowest pH because it contains the highest number of FFA (Meisner and Tenner, 1977). It also had the highest % moisture as well. The results of the present study are in agreement with those of Lorini and colleagues, who found that high moisture and high temperature seed storage affected oil quality parameters (Lorini et al., 2006). Interestingly, the used oil sample had several similar parameters to the other oils in the present study. Because of the quite low correlation between the 2 methods for analyzing % TPC, the Thai commercial test kit provided a rougher scale than the FOM 310 meter. Thus, the FOM 310 meter is recommended for the measurement of % TPC in oil samples on pig farms. The result of crude coconut and crude rice bran oils showed low level of PV, but huge number of % TPC, indicating that they were oxidized oils (Shurson et al., 2015).

In conclusion, a variety of qualities of oils used in Thai pig farms and feed mills were found in the present study. Thus, oil quality should be evaluated before use by the following parameters: % TPC, PV, FFA, IV, % impurity and % moisture. Particularly in palm oil, the parameters of PV, IV and FFA are crucial for the identification of crude and refined grades. However, FFA should be used to classify soybean oil into crude and refined grades. Moreover, it is suggested that sterile glass bottles should be used for collection of oil samples to reduce oxidation reaction.

Acknowledgements

This study was supported by the Center of Excellence on Agricultural Biotechnology, Science and Technology Postgraduate Education and Research Development Office, Office of Higher Education Commission, Ministry of Education (AG-BIO/PERDO-CHE). We would like to thank the pig farm owners for providing the oil samples. We also thank the veterinarians for collecting oil samples. Moreover, we are grateful to the Thai Vegetable Oil Public Company Limited (TVO), Nakhon Pathom province, Thailand for oil sample analysis.

References

AOCS 2009a. Free Fatty Acid Measurement (AOCS Official Method Ca 5a-40).

AOCS 2009b. Peroxide value Acetic Acid-Isooctane Method (AOCS Official Method Cd 8b-90).

APCC 2003. APCC Standard for Virgin Coconut Oil (Jakarta, Indonesia, Asian and Pacific Coconut Community).

Bhattacharya, A.B., Sajilata, M.G., Tiwari, S.R., Singhal, R.S., 2008. Regeneration of thermally polymerized frying oils with adsorbents. Food Chemistry 110(3): 562-570.

Boler, D.D., Fernández-Dueñas, D.M., Kutzler, L.W., Zhao, J., Harrell, R.J., Campion, D.R., McKeith, F.K., Killefer, J., Dilger, A.C., 2012. Effects of oxidized corn oil and a synthetic antioxidant blend on performance, oxidative status of tissues, and fresh meat quality in finishing barrows. Journal of Animal Science 90(13): 5159-5169.

Chakrabarty, M.M., 2003. Chemistry and Technology of Oils and Fats. Allied Publishers PVT. Limited, Mumbai.

Choe, E., Min, D.B., 2007. Chemistry of Deep-Fat Frying Oils. Journal of Food Science 72, R77-R86.

DeRouchey, J.M., Hancock, J.D., Hines, R.H., Maloney, C.A., Lee, D.J., Cao, H., Dean, D.W., Park, J.S., 2004. Effects of rancidity and free fatty acids in choice white grease on growth performance and nutrient digestibility in weanling pigs. J Anim Sci 82, 2937-2944.

FAO 2009. SECTION 2. Codex Standards for Fats and Oils from Vegetable Sources (Agriculture and Consumer Protection Department).

Firestone, D., Stier, R.F., Blumenthal, M.M., 1991. Regulation of frying fats and oils. Food Technology 45, 90-94.

ISO 2007. Animal and Vegetable fats and oils-Determination of insoluble impurities content (International Organization for Stadardization (ISO 663)).

Katragadda, H.R., Fullana, A., Sidhu, S., Carbonell-Barrachina, Á.A., 2010. Emissions of volatile aldehydes from heated cooking oils. Food Chemistry 120, 59-65.

Lin, S., Akoh, C.C., Reynolds, A.E., 2001. Recovery of used frying oils with adsorbent combinations: refrying and frequent oil replenishment. Food Research International 34, 159-166.

Liu, P., Kerr, B.J., Chen, C., Weber, T.E., Johnston, L.J., Shurson, G.C., 2014. Methods to create thermally oxidized lipids and comparison of analytical procedures to characterize peroxidation. J Anim Sci 92, 2950-2959.

Lorini, I., Bacaltchuk, B., Beckel, H., Deckers, D., Sundfeld, E., Santos, J.P.d., Biagi, J.D., Celaro, J.C., Faroni, L.R.D.A., Bortolini, L.d.O.F., Sartori, M.R., Elias, M.C., Guedes, R.N.C., Fonseca, R.G.d., Scussel, V.M., 2006. Proceedings of the 9th International Working Conference on Stored Product Protection. Brazilian Post-harvest Association, ABRAPOS, Passo Fundo, RS, Brazil.

Lubrizol, Test, Procedure, 2006. Determination of Iodine Value. Lubrizol Advanced Materials.

Meisner, H., Tenner, K., 1977. pH as an indicator of free fatty acid release from adipocytes. Journal of Lipid Research 18.

O'Brien, R.D., 2004. Fats and Oils: Formulating and Processing for Applications CRC Press, Boca Raton, Florida.

Ockerman, H.W., 1991. Food Science Sourcebook, Vol 2. AVI Publishing Company, New York.

Paul, S., Mittal, G.S., 1997. Regulating the use of degraded oil/fat in deep-fat/oil food frying. Critical reviews in food science and nutrition 37, 635-662.

Rosero, D.S., Odle, J., Moeser, A.J., Boyd, R.D., van Heugten, E., 2015. Peroxidised dietary lipids impair intestinal function and morphology of the small intestine villi of nursery pigs in a dose-dependent manner. British Journal of Nutrition 114, 1985-1992.

Shurson, G.C., Kerr, B.J., Hanson, A.R., 2015. Evaluating the quality of feed fats and oils and their effects on pig growth performance. Journal of Animal Science and Biotechnology 6, 10.

Song, R., Chen, C., Johnston, L.J., Kerr, B.J., Weber, T.E., Shurson, G.C., 2014. Effects of feeding diets containing highly peroxidized distillers dried grains with solubles and increasing vitamin E levels to wean-finish pigs on growth performance, carcass characteristics, and pork fat composition. J Anim Sci 92, 198-210.

Varady, J., K. Eder, Ringseis, R., 2011. Dietary oxidized fat activities the oxidative stress-responsive transcription factors NF-kB and Nrf2 in intestinal mucosa of mice. Eur. J. Nutr. 50, 601-609.

Yen, P.-L., Chen, B.-H., Yang, F.L., Lu, Y.-F., 2010. Effects of deep-frying oil on blood pressure and oxidative stress in spontaneously hypertensive and normotensive rats. Nutrition 26, 331-336.

Yin, H., Xu, L., Porter, N.A., 2011. Free radical lipid peroxidation: mechanisms and analysis. Chemical reviews 111(10): 5944-5972.

Zadernowskl, R., Nowak, P.H., Rashed, A.A., 1999. The influence of heat treatment on the activity of lipo- and hydropholic components of oat grain. Journal of Food Processing and Preservation 23, 177-191.

บทคัดย่อ

การสำรวจคุณภาพของน้ำมันที่ใช้ในฟาร์มสุกรของประเทศไทย

อลงกต บุญสูงเนิน[1,2,3] ประภัสสร บุญสูงเนิน[4] พิชัย จิรวัฒนาพงศ์[1] ณัฐวุฒิ รัตนวนิชย์โรจน์[1] ปริวรรต พูลเพิ่ม[1]*

การคำนวณสูตรอาหารในสุกรปกติจะต้องมีน้ำมันเป็นองค์ประกอบเพื่อเป็นแหล่งพลังงานในอาหาร การศึกษานี้ทำการเก็บตัวอย่างน้ำมันจำนวน 58 ตัวอย่าง ซึ่งประกอบด้วย 1) น้ำมันมะพร้าว (n=11), 2) น้ำมันปาล์มดิบ (n=6), 3) น้ำมันปาล์มบริสุทธิ์ (n=6), 4) น้ำมันถั่วเหลืองดิบ (n=4), 5) น้ำมันถั่วเหลืองบริสุทธิ์ (n=5), 6) น้ำมันรำข้าวดิบ (n=6), 7) น้ำมันไก่ (n=6), 8) น้ำมันหมู (n=5) และ 9) น้ำมันที่ผ่านการใช้งานแล้ว (n=9) จากโรงผสมอาหารในฟาร์มสุกร โรงงานผลิตอาหารสุกร และผู้ค้าน้ำมันในประเทศไทย ทำการตรวจคุณภาพตัวอย่างน้ำมันทั้งหมดโดยการวัด pH เปอร์เซ็นต์ของสารที่มีขั้วทั้งหมด (percentage of total polar compounds; % TPC) ค่าเปอร์ออกไซด์ (peroxide value; PV) ค่ากรดไขมันอิสระ (free fatty acid; FFA) ค่าไอโอดีน (iodine value; IV) เปอร์เซ็นต์ของสารที่ไม่บริสุทธิ์ (percentage of impurity; % impurity) และเปอร์เซ็นต์ความชื้น (percentage of moisture; % moisture) นอกจากจะพบว่า น้ำมันที่ต่างชนิดกันมีคุณภาพที่แตกต่างกันแล้ว การศึกษานี้ยังพบว่า น้ำมันแต่ละชนิดมีความผันแปรในแต่ละตัวอย่างอีกด้วย ผลของการเปรียบเทียบน้ำมันปาล์มชี้ให้เห็นว่า น้ำมันปาล์มดิบมีค่า FFA ที่สูงกว่าน้ำมันปาล์มบริสุทธิ์ (p=0.033) แต่กลับมีค่า PV ที่ต่ำกว่า (p=0.005) ส่วนการแยกชนิดของน้ำมันถั่วเหลืองเป็นน้ำมันถั่วเหลืองดิบกับน้ำมันถั่วเหลืองบริสุทธิ์สามารถใช้ค่า pH และ FFA ได้ นอกจากนี้ พบความสัมพันธ์ของการตรวจค่า % TPC โดยใช้ชุดตรวจสอบอย่างง่ายที่ผลิตขึ้นในประเทศไทยกับเครื่องมือตรวจวัด (FOM 310 meter) อยู่ในระดับต่ำ (ประมาณร้อยละ 25) ดังนั้น จึงแนะนำให้ทำการตรวจวัดค่า % TPC ในตัวอย่างน้ำมันด้วยเครื่องมือ FOM 310 meter จากผลการศึกษาทั้งหมดนี้สรุปได้ว่าน้ำมันที่จะใช้ในสูตรอาหารสุกรควรได้รับการตรวจสอบคุณภาพโดยการตรวจค่า % TPC, PV, FFA, IV, % impurity และ % moisture

คำสำคัญ: ดัชนีชี้วัดคุณภาพน้ำมัน ฟาร์มสุกร การสำรวจ ประเทศไทย

[1]ภาควิชาเวชศาสตร์และทรัพยากรการผลิตสัตว์ คณะสัตวแพทยศาสตร์ มหาวิทยาลัยเกษตรศาสตร์ วิทยาเขตกำแพงแสน นครปฐม ประเทศไทย

[2]ศูนย์เทคโนโลยีชีวภาพเกษตร มหาวิทยาลัยเกษตรศาสตร์ วิทยาเขตกำแพงแสน นครปฐม ประเทศไทย

[3]ศูนย์ความเป็นเลิศด้านเทคโนโลยีชีวภาพเกษตร สำนักพัฒนาบัณฑิตศึกษาและวิจัยด้านวิทยาศาสตร์และเทคโนโลยี สำนักงานคณะกรรมการการอุดมศึกษา กรุงเทพฯ ประเทศไทย

[4]ภาควิชากายวิภาคศาสตร์ คณะสัตวแพทยศาสตร์ มหาวิทยาลัยเกษตรศาสตร์ กรุงเทพฯ ประเทศไทย

***ผู้รับผิดชอบบทความ** E-mail: fvetpap@ku.ac.th*